

METHODS AND APPARATUS FOR PROVIDING APPLICATION CREDENTIALS

BACKGROUND

I. FIELD

[0001] The present invention relates generally to credential systems, and more particularly, to methods and apparatus for providing application credentials to applications running on a device for the purpose of authentication and security.

II. DESCRIPTION OF THE RELATED ART

[0002] Advances in technology have resulted in the development and deployment of extensive data networks. These networks include both public data networks, such as the Internet, and specialized networks, such as wireless telecommunication networks. Users of these networks have the ability to access a wide variety of information and services that are available as network resources.

[0003] One example where there is an increasing demand for network resources is in wireless network environments. In wireless environments, a variety of wireless devices, such as wireless telephones, personal digital assistants (PDAs), and paging devices, communicate over a wireless network. The wireless network may also include network servers that operate to provide various network resources to the wireless devices. Furthermore, the wireless networks may also be coupled to a public network, such as the Internet, so that resources on the public network can be made available to the wireless devices on the wireless network.

[0004] Typically, a wireless device may download an application program from a wireless network. The application may be downloaded for free or purchased by the user of the wireless device, who effectively obtains the rights to use the application or content for an unlimited, fixed, or usage count based expiration period. During execution, the application may attempt to retrieve proprietary data from a data server. For example, the application may be a news retrieval application, and during operation, the application requests news data from a proprietary news data server. Before transmitting the data, the data server needs to verify that the application is authorized to receive the data. It is therefore necessary for the application to authenticate to the data server.

[0005] However, strong authentication is not possible unless there is a secret shared between the device and the server that is different for every device. If that is not the case, reverse engineering of the application will reveal enough information to gain access to the server. The shared secret should be distributed out of band, and not over the network connection between the device and the server. One approach is to provision a separate key into every device at the time of manufacture or sale. This is how some systems operate to authenticate voice calls. However, this technique does not scale to large numbers of applications, doesn't work for applications that are downloaded after purchase of the device, and application vendors may not have access to the manufacturing or sales process.

[0006] Another technique is to issue separate passwords to the each device user where the passwords are distributed using voice mail, email, paper mail, or some other out of band means. This may provide a partial solution, however, this techniques results in more user responsibility, more overhead for the application or content developer, and the requirement to create, distribute, and maintain passwords for every application used by every user.

[0007] Therefore, what is needed is a system to provide application credentials that can be used by applications running on a device to authenticate their requests for data from proprietary data servers, where the application credentials provide strong authentication without the need to have multiple passwords for every device.

SUMMARY

[0008] In one or more embodiments, a credential system is described that provides credentials to applications running on a device. In one embodiment, an application running on a device provides an application identifier in a request for credentials that is sent to the credential system. The credential system uses the application identifier and a master credential to generate an application credential for use by the application. After obtaining the application credential, the application sends a request for data to a data server, and the request includes the application credential and the application identifier. The data server receives the request and includes the application identifier in a request for a server credential, which is sent to a credential server. The credential server has a copy of the master credential. The credential server uses the application identifier and the master credential to generate the server credential, which is transmitted back to the

data server. The data server then compares the application credential with the server credential, and if they match, the server sends the requested data to the application. Thus, it is possible for the application to authenticate to the data server without the use of special passwords.

[0009] In another embodiment, the data server transmits the application identifier and the application credential to the credential server in a request for credential verification. The credential server generates a server credential using the application identifier and the master credential. The credential server compares the application credential with the server credential and determines whether or not the two credentials match. If the credentials match, the credential server transmits a positive indicator to the data server, thereby authorizing the data server to transmit the requested data to the application.

[0010] In one embodiment, a method provides an application credential to an application running on a device, wherein the application credential is used by the application to authenticate to a data server. The method comprises receiving a request to generate the application credential, wherein the request includes an application identifier. The method also comprises generating the application credential using the application identifier and a master credential associated with the device.

[0011] In another embodiment, apparatus is provided that operates to provide an application credential to an application running on the device, wherein the application credential is used by the application to authenticate to a data server. The apparatus comprises receiving logic that operates to receive a request for the application credential, wherein the request includes an application identifier. The apparatus also comprises generating logic that operates to generate the application credential using the application identifier and a master credential.

[0012] In another embodiment, apparatus is provided that operates to provide an application credential to an application running on the device, wherein the application credential is used by the application to authenticate to a data server. The apparatus comprises means for receiving a request for the application credential, wherein the request includes an application identifier. The apparatus also comprises means for generating the application credential using the application identifier and a master credential.

[0013] In another embodiment, a computer-readable media is provided comprising instructions, which when executed by a processor in a device, provide an application credential to an application running on the device, wherein the application credential is

used by the application to authenticate to a data server. The computer readable media comprises instructions for receiving a request for the application credential, wherein the request includes an application identifier. The computer-readable media also comprises instructions for generating the application credential using the application identifier and a master credential.

[0014] In another embodiment, a method is provided for operating a credential server to authenticate an application running on a device, wherein the application transmits a request for data to a data server and the request comprises an application credential. The method comprises receiving an application identifier in a request for a server credential, and generating the server credential using the application identifier and a master credential. The method also comprises transmitting the server credential to the data server, wherein if the server credential and the application credential match the application is authenticated.

[0015] Other aspects, advantages, and features of the present invention will become apparent after review of the hereinafter set forth Brief Description of the Drawings, Detailed Description of the Invention, and the Claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The foregoing aspects and the attendant advantages of the embodiments described herein will become more readily apparent by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

[0017] **FIG. 1** shows a data network that comprises one embodiment of a credential system that provides application credentials to applications running on a wireless device;

[0018] **FIG. 2** shows a functional block diagram illustrating one embodiment of the wireless device of **FIG. 1** that includes one embodiment of a credential system that operates to provide application credentials to applications running on the device;

[0019] **FIG. 3** shows one embodiment of a method for operating a credential system to provide application credentials to an application running on a device;

[0020] **FIG. 4** shows a functional block diagram of a data server that includes one embodiment of a credential system that authenticates a request for data received from an application running on a device;

- [0021] **FIG. 5** shows one embodiment of a method for operating a data server in a credential system to authenticate an application credential provided by an application running on a device;
- [0022] **FIG. 6** shows a functional block diagram of another embodiment of a data server that includes one embodiment of a credential system that authenticates a request for data received from an application running on a device;
- [0023] **FIG. 7** shows one embodiment of a credential server that operates in a credential system to authenticate an application credential provided to an application running on a device;
- [0024] **FIG. 8** shows one embodiment of a method for operating a credential server in a credential system to authenticate an application credential provided by an application running on a device; and
- [0025] **FIG. 9** shows a functional block diagram of another embodiment of a credential server that includes one embodiment of a credential system that authenticates a request for data received from an application running on a device.

DETAILED DESCRIPTION

- [0026] The following detailed description describes a credential system that provides credentials to an application running on a device. The device may be any type of computing device such as a desktop computer, server, or other type of computer. The system is also well suited for use with portable devices such as, tablet computers, PDAs, wireless telephones, email devices, pagers or any other type of portable device. Therefore, although the system is suitable for use with a wide variety of devices, for the purpose of clarity, embodiments of the invention are described herein with reference to a wireless device.
- [0027] The device includes a copy of a master credential that was installed in the device during manufacture, or by using some other secure procedure that protects the master credential from public disclosure. The master credential is also known to a credential server.
- [0028] In one or more embodiments, the credential system interacts with a runtime environment executing on the device that is used to simplify operation of the device, such as by providing generalized calls for device specific resources. One such runtime environment is the Binary Runtime Environment for Wireless™ (BREW™) software

platform developed by QUALCOMM, Inc., of San Diego, California. In the following description, it will be assumed that the device is executing a runtime environment, such as the BREW software platform. However, one or more embodiments of the credential system are suitable for use with other types of runtime environments to provide application credentials to applications running on a variety of wired and wireless devices.

[0029] **FIG. 1** shows a data network **100** that comprises one embodiment of a credential system that provides application credentials to applications running on a device. The network **100** comprises a wireless device **102** that communicates with a data network **104** via a wireless communication channel **106**. The network **100** may be any type of data network and comprise both wired and wireless components. The network **100** also comprises a credential server **108** that operates to provide services to the wireless device **102** and other entities in communication with the network **104**. For example, the wireless device **102** may be a wireless telephone, and the credential server **108** may be part of a nationwide telecommunications network that provides telecommunication services to the device **102**. Also in communication with the network **104** is a data server **110**. The data server **110** operates to provide data, such as multimedia content or other types of data, to devices that are in communication with the wireless network **104**.

[0030] In one embodiment, the device **102** includes a master credential **114** that was installed in the device during manufacture or by using some other secure procedure. The master credential **114** may be any type of suitable credential that is not made public to allow the device **102** to authenticate to other entities, such as the credential server **108**. The device **102** also comprises credential generation logic **116**. The credential generation logic **116** generates a credential based on specific input information. In one embodiment, the logic **116** uses a “one-way” generation technique so that the generated credential cannot be decoded or reversed to determine the input information that was used to generate the credential. For example, the logic **116** may use a hash function to generate the credential.

[0031] During operation, the credential system operates to provide application credentials to an applications running on the device **102** by performing one or more of the following steps.

1. An application program **118** running on the device **102** requests an application credential from the credential system. The application includes an application

identifier (ID) in the request for the application credential. The request for the application credential is shown at **128**.

2. The credential system uses the application ID and the Master Credential **114** to generate the application credential for the application **118**. The application credential is returned to the application **118** as shown at **130**.
3. The application **118** sends the application credential, and optionally the ID, to the data server **110** with a request to obtain data. The request to obtain data is shown at **120**.
4. The data server **110** sends the ID to the credential server **108** in a request for a server credential. The request for the server credential is shown at **122**.
5. The credential server **108** uses the ID and the Master Credential **114** to generate a server credential using the credential generating logic **116** that is located at the credential server **108**. The resulting server credential is returned to the data server **110** as shown at **124**.
6. The data server **110** compares the application credential with the server credential, and if the two match, the application's request **120** for data is authenticated and the data server **110** transmits the requested data, as shown at **126**.

[0032] Therefore, because the application credentials can vary for each user, the system operates to authenticate both the user and the application.

[0033] **FIG. 2** shows a functional block diagram **200** illustrating one embodiment of the device **102** that includes one embodiment of a credential system that provides application credentials to applications running on the device **102**.

[0034] The device **102** comprises an application/ID signature checker **202**, credential generation logic **206**, a master credential **204**, an application **210**, an application ID **212**, and a digital signature **214**. The master credential **204** is stored in a secure non-volatile memory or other secure logic so that it is protected from erasure and unauthorized disclosure. The signature **214** was created by some application signing service or authority and binds the application **210** with the application ID **212**. In one or more embodiments, any type of modification detection technique can be used in place of the signature **214**.

[0035] The application/ID signature checker **202** detects if information encoded with the digital signature has been modified. It also allows the handset to know in a strong way that the application is truly the one assigned the particular application ID. For

example, by providing the application **210**, the ID **212**, and the signature **214** to the checker **202**, the checker **202** can determine if the application **210** and/or the ID **212** have been changed or modified after the digital signature was created. In one or more embodiments, the checker **202** operates with any type of modification detection technique.

[0036] The credential generation logic **206** generates a credential based on information received at its input. The generation logic **206** uses a “one-way” technique to generate the credential so that the credential cannot be decoded or reversed to determine the information used to create it.

[0037] During operation of one embodiment, the application **210** has an associated application ID **212** and a signature **214**. The signature **214** binds the application **210** and the ID **212**. The signature may have been generated by the application developer, or by a third party that is different from the application developer. The application **210** operates to retrieve data from a data server, for example, the data server **110** in **FIG. 1**. However, in order to retrieve the data, the application **210** needs to obtain an application credential to authenticate to the data server. The following method describes how in one embodiment, the credential system provides an application credential to the application **210**, so that the application **210** can authenticate to a data server, for example, the server **110**.

[0038] **FIG. 3** shows one embodiment of a method **300** for operating a credential system to provide application credentials to an application running on a device. For example, the method **300** will be described with reference to the device **102** shown in **FIG. 2**. It will be assumed that the application **210** is running on the device **102** and that the application **210** requires an application credential to authenticate to a data server to retrieve data.

[0039] At block **302**, the device operates to determine whether the application **210** and/or its ID **212** have been modified or incorrectly associated. In one embodiment, the application **210**, the ID **212**, and the signature **214** are sent to the checker **202**, as shown by path **224**. The checker **202** operates to use any known technique to verify that the application **210** and/or the ID **212** have not been modified.

[0040] At block **304**, the application requests an application credential from the credential system so that the application can authenticate to a data server to retrieve data. In one embodiment, the application's ID **212** is provided to the credential generation logic **206**, as shown by path **216** in a request for an application credential.

Note that the application's ID **212** is provided after being checked so that an application can not provide an arbitrary ID in order to get credentials for other applications.

[0041] At block **306**, an application credential is generated for the application. In one embodiment, the generation logic **206** generates the application credential **208** using the application ID **212**, and the master credential **204**. For example, in one embodiment, the generation logic **206** uses a hash function to generate the application credential **208**, so that the application credential **208** cannot be decoded or reversed to discover the master credential **204**. The application credential **208** is then returned to the application **210** as shown by path **218**. Because the application credential **208** is generated using a "one-way" technique, the master credential **204** is never at risk of being discovered or disclosed.

[0042] At block **308**, the application credential is used by the application to authenticate to a data server to retrieve data for use on the device. For example, the application **210** transmits the credential **208** in a request for data to the data server, as shown by path **220**. The request may also include the application's ID **212**. For example, the request is transmitted to the data server **110** in **FIG. 1**. The data server **110** may already have access to the application's ID, and so it may not be necessary for the device to transmit the ID to the data server.

[0043] At block **310**, assuming the application's data request is authenticated; the requested data is transmitted to the application **210** from the data server, as shown by path **222**. For example, the data server **110** receives the request from the application **210** and operates to authenticate the application before transmitting the requested data. A more detailed description of the authentication process performed by the data server is provided in another section of this document.

[0044] The method **300** is intended to be illustrative and not limiting of the operation of the various embodiments described herein. For example, it would be obvious to one with skill in the art to make minor changes, additions or deletions to any of the described methods. Furthermore, the described method steps may be combined, rearranged or reordered without deviating from the scope of the described embodiments.

[0045] **FIG. 4** shows a functional block diagram **400** of the data server **110** that includes one embodiment of a credential system that authenticates a request for data received from an application running on a device. For example, the server **110** receives a request for data from the application **210** and the request includes the application credential **208** and the application ID **212**. After the server **110** authenticates the

request, it provides the requested data to the application **210**. The server **110** comprises a content server **404**, content/data **406**, credential and matching logic **402**.

[0046] In one embodiment, the credential matching logic **414** operates to receive the application credential and the server credential and compare them. The result of the comparison **418** is sent to the content server **404**. Usually the result **418** will be approval when the credentials are equal in value. The essential difference between the application credential **208** and the server credential **414** is that former was generated on the end user device and the later on the server.

[0047] It should be noted that the configuration of the server **110** is just one configuration suitable for implementing one embodiment of the credential system. It is also possible to implement the credential system using other servers or server configurations within the scope of the present invention.

[0048] **FIG. 5** shows one embodiment of a method **500** for operating a data server in a credential system to authenticate an application credential provided by an application running on a device. For example, the method **500** will be described with reference to the server **110** shown in **FIG. 4**. It will be assumed that the application **210** is running on the device **102**, and that the application **210** obtains the application credential **208** from the credential system. The application **210** submits the application credential **208** and the application ID **212** in a request for data to the data server **110**.

[0049] At block **502**, the data server receives a request for data from an application running on a device. The request for data comprises the application credential **208** and the application ID **212**.

[0050] At block **504**, the data server requests a server credential from a credential server. For example, the application ID **212** and an authentication token **408** are sent (shown by **410** and **412**) to the credential server in a request for a server credential. For example, the request is transmitted to the credential server **108**.

[0051] At block **506**, the server credential is received from the credential server. For example, the credential server **108** generates a server credential **414** using the application ID **212** and a copy of the master credential **204** stored at the credential server **108**. The server credential **414** is generated using the same credential generation technique that was used to generate the application credential **208**.

[0052] At block **508**, a test is performed to determine if the server credential **414** matches the application credential **208**, thereby authenticating the application **210** as the data requestor. For example, the matching logic **402** matches the two credentials using

any type of matching technique. If the two credentials match, a positive indicator is provided at the matching output **418**. As a result, the application's **210** data request is authenticated and the content server **404** operates to transmit content/data **406** to the application **210** to satisfy the application's data request. If the two credentials do not match, a negative indicator is provided at the match output **418** and the content server **404** does not provide any data in response to the data request.

[0053] The method **500** is intended to be illustrative and not limiting of the operation of the various embodiments described herein. For example, it would be obvious to one with skill in the art to make minor changes, additions or deletions to any of the described methods. Furthermore, the described method steps may be combined, rearranged or reordered without deviating from the scope of the described embodiments.

[0054] **FIG. 6** shows a functional block diagram **600** of another embodiment of the data server **110** that includes one embodiment of a credential system that authenticates a request for data received from an application running on a device. In the embodiment shown in **FIG. 6**, the server **110** includes a credential forwarder **602** that forwards the ID **212**, the authentication token **408**, and the application credential **208** (shown at **410**, **412**, and **604**) to the credential server. The credential server generates a server credential and compares the server credential with the application credential **208**. If the application credential and the server credential match, the credential server transmits an authorization **606** to the data server **110**. The authorization is forwarded (via path **418**) to the content server **404**, which then operates to transmit the content/data **406** to the requesting application **210**. Thus, in the embodiment shown in **FIG. 6**, the credential server operates to compare the application credential to the server credential, where in the embodiment of **FIG. 4**, the data server **110** performs this comparison.

[0055] **FIG. 7** shows one embodiment of the credential server **108** that operates in a credential system to authenticate an application credential provided to an application running on a device. The credential server **108** comprises verification logic **702**, the master credential **204** and the credential generation logic **706**.

[0056] **FIG. 8** shows one embodiment of a method **800** for operating a credential server in a credential system to authenticate an application credential provided by an application running on a device. For example, the method **800** will be described with reference to the credential server **108** shown in **FIG. 7**. It will be assumed that the data server **110** has sent a request to the credential server **108** to obtain a server credential that can be matched to the application credential **208**. The request for the server

credential received by the credential server **108** includes the application ID **212** and the authentication token **408**.

[0057] At block **802**, the credential server **108** receives the request from the data server to obtain a server credential. For example, the data server **110** transmits a request to the credential server **108** to obtain a server credential, and the request includes the application ID **212** and the authentication token **408**.

[0058] At block **804**, the credential server **108** uses the authentication token **408** to authenticate the request at the verification logic **702**. This authentication is used to be sure the request being made for a given application ID **212** from a data server that is allowed to access server credentials **414** belonging to the application indicated by the application ID **212**.

[0059] At block **806**, after the request has been verified, the credential generation logic **706** uses the application ID **212** and the master credential **204** to generate the server credential **414**. The credential generation **706** logic in most embodiments will be functionally the same as the logic **206** on the end device **102**.

[0060] At block **808**, the credential server transmits the server credential **414** to the data server (as shown by path **704**) so that the data server may use the server credential to authenticate a data request from an application running on a device.

[0061] The method **800** is intended to be illustrative and not limiting of the operation of the various embodiments described herein. For example, it would be obvious to one with skill in the art to make minor changes, additions or deletions to any of the described methods. Furthermore, the described method steps may be combined, rearranged or reordered without deviating from the scope of the described embodiments.

[0062] **FIG. 9** shows a functional block diagram **900** of another embodiment of the credential server **108** that includes one embodiment of a credential system that authenticates a request for data received from an application running on a device. In the embodiment shown in **FIG. 9**, the server **108** receives the application credential **208** and includes credential-matching logic **902**.

[0063] During operation, the credential generation logic **706** generates the server credential **414**, which is then compared to the application credential **208** at the credential matching logic **902**. If the application credential **208** and the server credential **414** match, the credential server transmits the authorization **606** to the data server **110**. Thus, in the embodiment shown in **FIG. 9**, the credential server **108**

operates to compare the application credential **208** to the server credential **414**, where in the embodiment of **FIG. 7**, the data server **110** performs this comparison.

Implementations

- [0064] The above-described systems comprise interconnected functional elements that may be embodied in a variety of implementations. For example, any of the described elements may comprise a CPU, processor, gate array, hardware logic, memory, software, or any combination of hardware and software. Each system further comprises logic to execute machine-readable instructions to perform the functions described herein.
- [0065] In one or more embodiments, the machine readable instructions are stored on computer-readable media that interfaces to any of the described systems, so that the instructions may be downloaded into the systems for execution to perform the described functions. The computer-readable media comprises floppy disks, hard disks, Flash memory, RAM, ROM, CDROM or any other type of computer-readable media that may contain instructions for execution by the systems described herein.
- [0066] A credential system has been described that includes methods and apparatus to provide credentials to applications running on a device. The system is suitable for use with all types of devices and is especially well suited for use with wireless devices, such as mobile telephones, to provide application credentials to applications that need to authenticate to data servers or other systems.
- [0067] Accordingly, while one or more embodiments of methods and apparatus for a credential system have been illustrated and described herein, it will be appreciated that various changes can be made to the embodiments without departing from their spirit or essential characteristics. Therefore, the disclosures and descriptions herein are intended to be illustrative, but not limiting, of the scope of the invention, which is set forth in the following claims.

I CLAIM: